1883MNRAS..43...97D

The second letter is dated "Mamhead ♄ September 15,–66," and is addressed "For Sir Robert Moray K^{t} at Whitehall, These."

"I designe to send you all the figures of ♄. I promised them my L^{d} Brounker and hee was pleased most kindly to accept itt but I (like any thing you please to call mee bad enough) have hitherto shamfully failed, as alsoe of an account of husbandry to Mr. Oldenburg. I am still gazing at the starrs though to very little purpose more then to keep my eyes in use,"&c. &c.

It will be noticed that the passage in Ball's first letter in which he claims to be unbiased by any hypothesis, agrees with the statement of Huyghens respecting him.

The passage in the same letter, "for the shadow of the body on his ring I doe not well understand the meaning but I suppose I saw the same thing," I conjecture to refer to an attempted explanation by Huyghens, or some other astronomer, of the phenomenon observed by Ball, by attributing it to the shadow of the body of the planet cast on his ring.

It is plain that such an explanation would not be applicable, if similar depressions had been observed at the two extremities of the minor axis of the ring.

Observations of Jupiter. By W. F. Denning.

The southern equatorial belt of *Jupiter* is by far the most conspicuous feature at present visible on the surface of the planet. This belt is double, and can be readily traced as two perfectly parallel bands in all parts of the circumference except in the region immediately N. of the great red spot where it is connected at the *p.* and *f.* ends of the spot. At these points the southernmost half of the belt slopes abruptly to the N., and runs into the northernmost half, so that the great red spot now apparently lies south of a great cavity in the configuration of the dusky equatorial belts.

In the immediate region of the planet's equator, numerous dark spots and irregular patches appear from time to time, and it is important that the rotation period of these objects should be determined. They usually lie on the equatorial border of the great S. belt, and in approximately the same latitude as the permanent white spots to which so much attention has lately been given. On Oct. 26, 1882, just before daylight, I noticed a very conspicuous marking of this character slightly preceding the white equatorial spot. I re-observed this peculiar dark spot on many subsequent occasions, and recorded its times of transit across the central meridian of *Jupiter* relatively to the well-known white spot. The results show that the two objects have a common rotation period, whence we may assume that all the various markings both light and dark along the equator

1883MNRAS..43...97D

participate in a swift movement past the red spot. The following were the estimated times of transit recorded between Nov. 1 and Nov. 26, after which cloudy weather and other circumstances prevented a continuation of the observations :—

1882.	Equatorial Dark Spot central.	Equatorial White Spot central.	Dark Spot precedes White Spot.
	h m	h m	m
Nov. 1	17 22	17 40	18
3	18 33	18 50	17
4	14 7	14 25	18
5	9 48	10 1	13
8	16 33	16 48	15
9	12 13	12 28	15
10	17 48	18 3	15
26	7 30	7 45	15
26	17 24	17 37	13

The interval separating the spots decreased from 18^m to 13^m during the 25 days, but considering the approximate nature of the observations and the fact that the estimated intervals were identical on Nov. 5 and 26, it is certain that the difference (if any) in the rotation periods of the two objects must have been so small as to escape certain detection. It therefore appears that the frequent obscuration of the white equatorial spots are not originated by a swifter motion of the dark spots in the same latitude, for both objects are seemingly influenced by the same current. This accords with Prof. Hough's observations in 1881 ; he found that the drift of the dark matter in the equatorial regions was essentially the same as that of the white spots. While, however, a uniform velocity appears to influence these markings on the equatorial half of the great Southern belt, causing them to become displaced, relatively to the position of the red spot, to the extent of 8° of longitude daily, it is certain that the southernmost half of the belt remains stationary with reference to the red spot, for during the three oppositions of 1880, '81, and '82 the junction of the belt N. of the *f* end of the red spot has retained a fixed position.

In the region N. of the planet's equator many changes have occurred during the last few months. A considerable number of dusky patches have made their appearance, and a few brilliant white spots are visible where, in 1880, the planet's dark N. belt was very conspicuous. In November I observed the return of a brilliant spot N. of the equator, and found that it moved perceptibly slower than the somewhat similar and evidently more permanent spot slightly S. of the equator. The following were the times :—

1883MNRAS..43...97D

1882.	N. equatorial White Spot central.	S. equatorial White Spot central.		
	h m	h m		m
Oct. 30	15 56	16 22	N. spot precedes S.	26
Nov. 1	17 22	17 40	,, ,,	18
3	18 41	18 50	,, ,,	9
4	14 23	14 25	,, ,,	2
5	10 4	10 1	,, follows S.	3
8	17 1	16 48	,, ,,	13
9	12 39	12 28	,, ,,	11
10	18 22	18 3	,, ,,	19
11	14 5	13 43	,, ,,	22
19	9 25	8 37	,, ,,	48
26	18 48	17 37	,, ,,	71

The spot N. of the equator lost 97 minutes in 27 days, so that (the period of the S. spot being $9^h\ 50^m\ 7^s$) its rotation was performed in about $9^h\ 51^m\ 40^s$, or 4 minutes less than the red spot and $1\frac{1}{2}$ minutes greater than that of the white spot S. of the equator. On Nov. 26 the N. spot had become extremely faint and could not be followed any longer, yet early in November it was far brighter than the S. spot, and formed a very conspicuous feature upon the planet.

It is evident from these and many other recent observations of markings included within the equatorial belts, and of those situated further towards the poles, that the rotation periods vary in a very irregular and unaccountable manner. They do not seem to be affected or controlled by any law depending upon their latitudinal distribution. It appears certain, however, that the markings on and skirting the planet's equator *generally* move with far greater velocity than those outside the equatorial belts. This conclusion is warranted by the independent results of several observers, but it is nevertheless liable to great exceptions. In the autumn and winter of 1880 an eruption of dark spots occurred on a belt approximately situated 25° N. of the planet's equator. These spots were first seen by Mr. F. C. Dennett at Southampton, on Oct. 17, and afterwards very generally observed, when it was found that they not only increased in numbers and size, but showed a rapid motion relatively to the red spot. Their rotation period was about $9^h\ 48^m$, and they completed a revolution of *Jupiter* relatively to the red spot in about 32 days. These markings moved with greater velocity than any others, the periods of which have ever been determined, and the fact is very important as they were so far removed from the equator.

Prof. Hough, in his valuable summary of observations at Chicago, says: "The observations of the small white spots during 1880 and 1881 prove that the whole surface of the planet outside the margin of the equatorial belt rotates with nearly the

1883MNRAS..43...97D

same rate;" and, "From observations on the small white spots, as well as on dark markings near the equator, it is probable that the matter in the equatorial regions constantly drifts in the direction of the planet's rotation; and it seems probable that the rate of this drift depends on the latitude." The dark spots seen in 1880 far N. of the equator, by many English observers, apparently furnish a negative to this conclusion. It is possible, however, that the small white spots outside the equatorial zone move slower than the dark markings referred to. It is evident that the different velocities of the various spots offer a very complex problem for solution. It may be that though these velocities follow no law dependent upon distance from the equator, they may each be special to the zones in which they occur. Or they may possibly be accounted for on the thesis that the planet is enveloped in a series of dense atmospheric layers or shells, each of which, according to height, manifests a different rate of motion, which becomes revealed either by temporary disruption or partial decadence of the outer envelopes. There is, probably also vast differences of temperature in the various markings observed, and this may originate another element of disturbance. In any case, we may be assured that all the varieties of spots and streaks observed so persistently and numerously upon the planet are the phenomena of his dense atmosphere and not objects of stability upon his actual surface, which seems to be entirely shrouded from our scrutiny by masses of heated vapour which are woven into parallel bands by the effects of a very rapid rotatory movement. The further telescopic study of these remarkable markings cannot fail to prove of considerable interest, and may perhaps lead to the partial elucidation of what now appears to present difficulties beyond explanation.

Bristol: 1883, *Jan.* 11.

Postscript, on a Communication made to the Royal Astronomical Society, in November last, on Stellar Photometry. By Professor C. Pritchard, D.D., F.R.S.

Since my last communication in November 1882, I have had an opportunity of examining another wedge of neutral-tinted glass constructed for Mr. Knott by Mr. Hilger. It has been scrupulously measured by the same photometrical process as that described in my paper already referred to. The instrument I find to be practically uniform in its action throughout its extent of 6 inches in length, but I have also furnished Mr. Knott with a table, theoretically exact, by means of which, from simple inspection, he may be able to reduce the graduated indications of the wedge to the difference of the magnitudes of any star whose light is just extinguished by the instrument. I need scarcely repeat that, although on different nights, the same star will be